E 1.28: SOLAR/2008-79/05

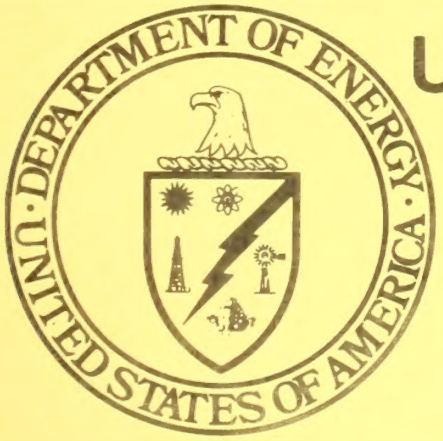
Aleph 1214322

SOLAR/2008-79/05

Monthly Performance Report

ARATEX SERVICES, INC.

MAY 1979



U.S. Department of Energy

National Solar Heating and Cooling Demonstration Program

National Solar Data Program

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, nor any of their contractors, subcontractors, or their employees, make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

MONTHLY PERFORMANCE REPORT
ARATEX SERVICES, INC.
MAY 1979

I. SYSTEM DESCRIPTION

The ARATEX Services, Inc. site is an industrial laundry in Fresno, California. The solar energy system is designed to provide approximately 20 percent of the energy to maintain the temperature of the process water at 180°F. It has an array of 140 flat-plate, Lexan-glazed collectors manufactured by Ying Manufacturing Company. They face south at a tilt of 30 degrees from the horizontal. The collectors have a gross area of 6,500 square feet. Water is used as the medium for delivering solar energy from the collector array to storage. The solar heated water is stored in a 12,000-gallon tank. Auxiliary energy is supplied by a low pressure, gas-fired boiler. In addition, a heat exchanger, utilizing energy from a waste water storage tank, preheats the city water input supply. The solar energy system can be isolated from the auxiliary heating system in the event of a malfunction without a reduction in overall system heating capacity.

The system, shown schematically in Figure 1, has three modes of operation.

Mode 1 - Collector-to-Storage: During this mode of operation, water is pumped from the water solar thermal storage through the collectors and back into storage. This mode is entered when the temperature of the collector outlet exceeds the storage temperature by 4.5°F and continues until this differential temperature drops below 1.5°F.

Mode 2 - Hot Water Demand: This mode is entered when there is a demand by the laundry for hot water. City water entering the Domestic Hot Water (DHW) system is preheated using the waste water in the 16,500-gallon holding tank. The temperature of the input city water is raised to approximately 115°F before entering water solar thermal storage. As

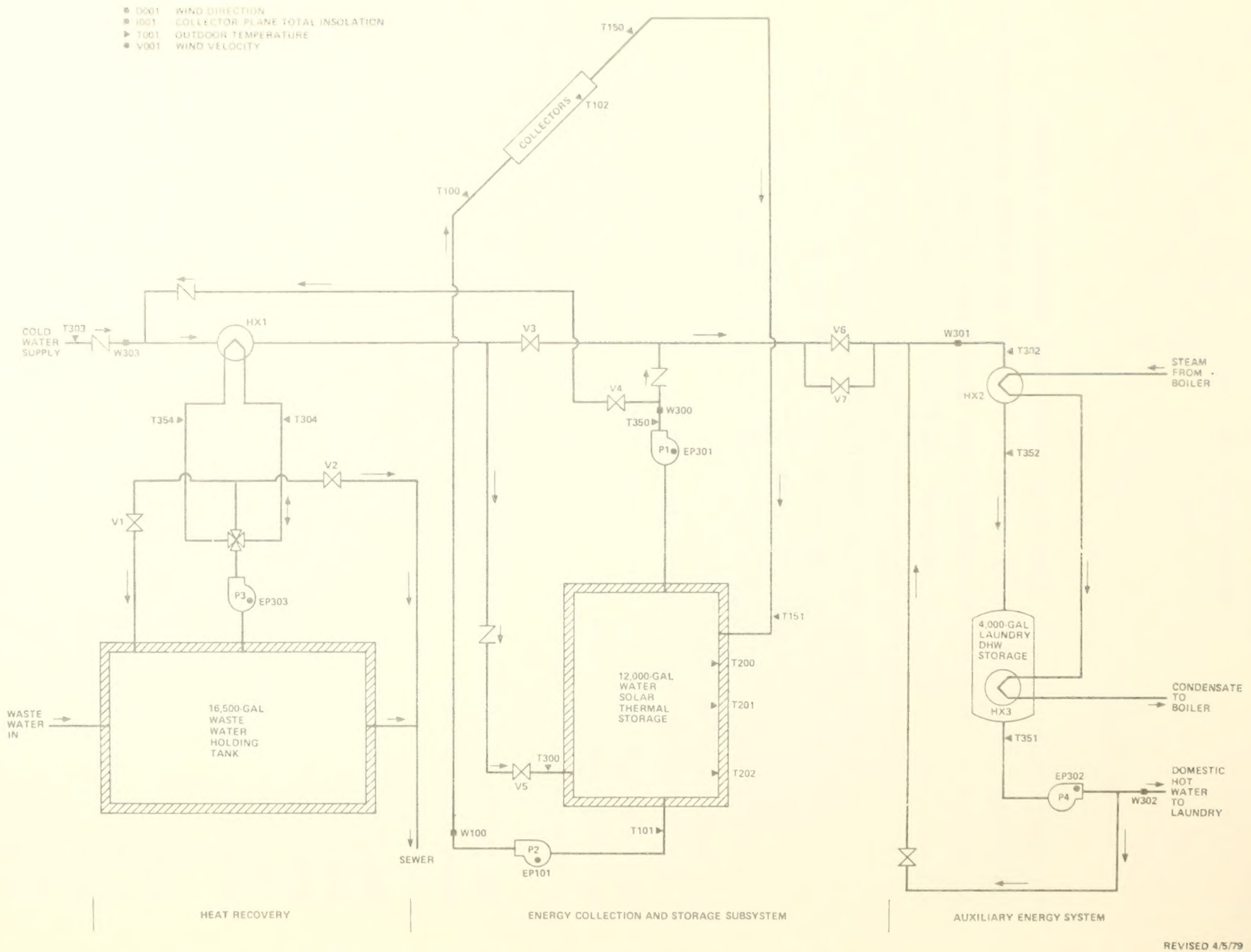


Figure 1. ARATEX SERVICES INC. SOLAR ENERGY SYSTEM SCHEMATIC

water is withdrawn from water solar thermal storage, it passes through steam heat exchanger HX2, where auxiliary energy is added to maintain the 4,000-gallon laundry DHW storage at 180°F. Additional energy is supplied to DHW storage by extracting energy from the condensate line of heat exchanger HX3, as shown in Figure 1.

Mode 3 - Storage-to-Waste Water: When the water in the water solar thermal storage reaches 180°F, it is circulated by reverse flow through heat exchanger HX1, in the heat recovery system, thus storing any excess solar energy in the waste water holding tank. This mode is used to prevent overheating the 12,000-gallon fiberglass storage tank and allows the waste water holding tank to be used as a secondary solar storage tank.

II. PERFORMANCE EVALUATION

A. Introduction

The system performance evaluations discussed in this section are based primarily on analysis of the data presented in the attached computer-generated monthly report. The report consists of daily site thermal energy values for each subsystem, plus environmental data. The performance factors discussed in this report are based upon the definitions contained in NBSIR 76-1137, Thermal Data Requirements and Performance Evaluation Procedures for the National Solar Heating and Cooling Demonstration Program.

The solar energy system at the ARATEX Services, Inc. site operated continuously during May and satisfied 24 percent of the hot water load. Hot water heating is the only solar-assisted function at this site. The total system load at ARATEX is defined as the sum of the energy supplied by the solar energy system, plus the energy supplied by the auxiliary energy system. The total load was 711.46 million Btu for the month of May.

B. Weather

The Fresno weather has no apparent impact on the energy requirements of the laundry. However, the weather does affect the solar energy collected and used by the laundry. The measured insolation in the plane of the collector array averaged 2,126 Btu/ft^2-day, during May, which is near the long-term average of 2,198 Btu/ft^2-day, as derived from measurements taken from the Fresno Airport.

C. System Thermal Performance

Collector Array - Of the 430.28 million Btu of solar energy incident on the collector array during May, only 321.84 million Btu were incident on the array when the collector loop pump P2 was operating. The system collected 119.50 million Btu, or approximately 28 percent of the total insolation incident on the collector array. The operation of the collector pump required 2.19 million Btu.

Storage - The time-average daily temperatures of storage during May ranged from 99°F to 180°F, resulting in an average daily temperature of 139°F for the month. The calculated value of storage efficiency was 100 percent.

Commercial Hot Water Load - During May, there were 22 working days at ARATEX Laundry. A total of 849,468 gallons of hot water was used, for an average of 38,612 gallons of hot water per work day. The value of 27,402 gallons per day shown in the Hot Water Subsystem section of the computer printout is based on 31 days of consumption, which includes weekends and holidays when the water usage is normally zero.

The city water supply entered the heat recovery system at an average temperature of 75°F and was raised to an average temperature of 108°F by extracting 219.08 million Btu of energy from the waste water holding tank. Solar energy and auxiliary energy were added to raise the process water temperature to an average of 174°F. The resulting total system hot water

load was 711.46 million Btu. Of the 711.46 million Btu total system load, 219.09 million Btu were supplied by the heat recovery system. This reduced the energy requirements on the solar and auxiliary energy subsystems to 492.38 million Btu. Of the 492.38 million Btu, 119.50 million Btu were supplied by the solar energy system. The remaining 372.87 million Btu were supplied by the auxiliary energy system.

D. Observations

It can be observed in the attached computer printout of this report that the solar energy collected and the solar energy delivered to storage are the same. This is because both were calculated using the measurements W100, T101, and T151. Normally the solar energy collected is computed as a function of W100, T100, and T150, while the energy delivered to storage is computed as a function of W100, T101, and T151. The difference in calculating solar energy collected during May, using T101 and T151 as opposed to T100 and T150 results in a measured value of nine percent less energy collected.

Solar energy collected using T101 and T151 was more consistent with changes in stored energy during periods when no energy was being extracted from storage, than was the case when T100 and T150 were used to calculate solar energy collected. These energy imbalances can be caused by relatively small uncertainties in the temperature measurements. This is because of the large mass flow rate through the collector array and the small (approximately 5°F to 7°F) temperature change across the collector array. No instrumentation changes would solve this problem. Therefore, for each month, data will be evaluated to determine which sensors most nearly results in a total system energy balance.

In the storage performance subsection of the computer printout, it can be observed that all energy delivered to storage is assumed to have been used. This is due to a problem with calculating solar energy extracted from storage for the ARATEX system. This problem as described below has always existed, but appears to be more severe during periods when very little solar energy is delivered to storage.

During May, the calculated value of solar energy extracted from solar storage using the measurements W300, T300 and T350 exceeded the solar energy delivered to storage. This anomaly is not believed to be an instrumentation problem, but is due to the idiosyncrasies of system operation. When calculating energy terms, it is desirable to have flow across both temperature sensors simultaneously. Otherwise, one sensor will record stagnant conditions instead of actual fluid temperature. Because flow into the solar storage tank and flow out of this tank is in general asynchronous, an attempt is made to minimize the effect of stagnant water temperature measurement by maintaining past values of T300 corresponding to past values of flow sensed by W303. These past values of T300 are then used in calculating solar energy from storage.

Digitized by the Internet Archive
in 2012 with funding from
University of Florida, George A. Smathers Libraries with support from LYRASIS and the Sloan Foundation

For the ARATEX system, this procedure is reasonable because all piping and tanks are well insulated and energy collection and usage are in-phase except on weekends and holidays when the laundry is not in use. Occasional inaccuracies may occur while valve V3 is open and valve V5 closed, thereby producing flow at W303 and no flow at T300. This situation cannot be detected because the valves are not instrumented. This problem can be accommodated by assuming that all energy collected and delivered to storage is used to meet the load requirements. This assumption was made during May, and the storage performance report reflects these data.

http://archive.org/details/montrfor0unit

The total hot water consumed at ARATEX is based on the flow sensor W303 as opposed to W302. When comparing the integrated values of W303, W300, and W302 for the month, the result of using W303 more nearly represents the expected hot water consumption. However, using W303 can be misleading when observing hot water consumption on a daily basis, since filling the tanks will appear as hot water consumption; this, however, has little effect on the monthly values.

During the month of May, the total energy required to raise the water from the average inlet temperature of 75°F to an average outlet temperature of 174°F was 711.46 million Btu. This 711.46 million Btu is in comparison to the design load of 1,728.03 million Btu. The difference between the actual hot water load and the design load is due to the difference in actual hot water consumption and the expected consumption when the system was in the design phase.

E. Energy Savings

The equivalent fossil fuel saved by the use of solar energy was 199.17 million Btu at the expense of 2.19 million Btu of electrical energy to operate the solar collector pump, P2. The heat recovery system supplied 219.09 million Btu of thermal energy to meet the hot water load requirements. Converting this to fossil fuel requirements, it amounts to 365.15 million Btu of additional fossil fuel savings. The operating expense of the heat recovery system was 1.25 million Btu. The fossil energy savings computations for solar as well as the heat recovery system are based on a comparison of the projected energy requirements of a conventional fossil fuel boiler with an efficiency of 0.60 and the energy requirements of the solar energy system.

III. ACTION STATUS

None.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: ARATEX SERVICES, INC. SOLAR/2008-79/05
REPORT PERIOD: MAY,1979

SITE/SYSTEM DESCRIPTION:
THIS SITE IS AN INDUSTRIAL LAUNDRY WHICH USES SOLAR ENERGY TO SUPPLY HEAT FOR HOT WATER. IF SUFFICIENT SOLAR ENERGY IS NOT COLLECTED TO SUPPLY THE HEATING REQUIREMENTS FOR HOT WATER, AUXILIARY ENERGY FROM A GAS-FIRED LOW PRESSURE STEAM BOILER IS USED TO MEET THE HEAT NEEDS.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	430.279	MILLION BTU
	65913	BTU/SQ.FT.
COLLECTED SOLAR ENERGY	119.503	MILLION BTU
	18306	BTU/SQ.FT.
AVERAGE AMBIENT TEMPERATURE	73	DEGREES F
AVERAGE BUILDING TEMPERATURE	N.A.	DEGREES F
ECSS SOLAR CONVERSION EFFICIENCY	0.28	
ECSS OPERATING ENERGY	2.188	MILLION BTU
TOTAL SYSTEM OPERATING ENERGY	15.197	MILLION BTU
TOTAL ENERGY CONSUMED	757.397	MILLION BTU

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL	
LOAD	492.377	N.A.	N.A.	492.377	MILLION BTU
SOLAR FRACTION	24	N.A.	N.A.	24	PERCENT
SOLAR ENERGY USED	119.503	N.A.	N.A.	119.503	MILLION BTU
OPERATING ENERGY	13.008	N.A.	N.A.	15.197	MILLION BTU
AUX. THERMAL ENERGY	372.874	N.A.	N.A.	372.874	MILLION BTU
AUX. ELECTRIC FUEL	N.A.	N.A.	N.A.	N.A.	MILLION BTU
AUX. FOSSIL FUEL	622.699	N.A.	N.A.	622.699	MILLION BTU
ELECTRICAL SAVINGS	N.A.	N.A.	N.A.	-2.188	MILLION BTU
FOSSIL SAVINGS	199.173	N.A.	N.A.	199.173	MILLION BTU

SYSTEM PERFORMANCE FACTOR: 0.731

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM,FEBRUARY 28,1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: ARATEX SERVICES, INC. SOLAR/2008-79/05
REPORT PERIOD: MAY,1979

SITE/SYSTEM DESCRIPTION:
THIS SITE IS AN INDUSTRIAL LAUNDRY WHICH USES SOLAR ENERGY TO SUPPLY HEAT FOR HOT WATER. IF SUFFICIENT SOLAR ENERGY IS NOT COLLECTED TO SUPPLY THE HEATING REQUIREMENTS FOR HOT WATER, AUXILIARY ENERGY FROM A GAS-FIRED LOW PRESSURE STEAM BOILER IS USED TO MEET THE HEAT NEEDS.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	453.944	GIGA JOULES
	748508	KJ/SQ.M.
COLLECTED SOLAR ENERGY	126.076	GIGA JOULES
	207886	KJ/SQ.M.
AVERAGE AMBIENT TEMPERATURE	23	DEGREES C
AVERAGE BUILDING TEMPERATURE	N.A.	DEGREES C
ECSS SOLAR CONVERSION EFFICIENCY	0.28	
ECSS OPERATING ENERGY	2.309	GIGA JOULES
TOTAL SYSTEM OPERATING ENERGY	16.032	GIGA JOULES
TOTAL ENERGY CONSUMED	799.053	GIGA JOULES

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL	
LOAD	519.457	N.A.	N.A.	519.457	GIGA JOULES
SOLAR FRACTION	24	N.A.	N.A.	24	PERCENT
SOLAR ENERGY USED	126.076	N.A.	N.A.	126.076	GIGA JOULES
OPERATING ENERGY	13.724	N.A.	N.A.	16.032	GIGA JOULES
AUX. THERMAL ENG	393.382	N.A.	N.A.	393.382	GIGA JOULES
AUX. ELECTRIC FUEL	N.A.	N.A.	N.A.	N.A.	GIGA JOULES
AUX. FOSSIL FUEL	656.947	N.A.	N.A.	656.947	GIGA JOULES
ELECTRICAL SAVINGS	N.A.	N.A.	N.A.	-2.309	GIGA JOULES
FOSSIL SAVINGS	210.127	N.A.	N.A.	210.127	GIGA JOULES

SYSTEM PERFORMANCE FACTOR: 0.731

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM,FEBRUARY 28,1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SITE: ARATEX SERVICES, INC.
REPORT PERIOD: MAY,1979

SOLAR/2008-79/05

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-F	ENERGY TO LOADS MILLION BTU	AUX THERMAL TO ECSS MILLION BTU	ECSS OPERATING ENERGY MILLION BTU	ECSS ENERGY REJECTED MILLION BTU	ECSS SOLAR CONVERSION EFFICIENCY
1	13.623	61	3.790	N	0.066	N	0.264
2	10.811	65	2.991	O	0.058	O	0.272
3	13.977	72	4.917	T	0.083	T	0.352
4	13.383	70	4.241		0.077		0.317
5	13.808	66	2.286	A	0.055	A	0.166
6	15.072	61	0.877	P	0.028	P	0.058
7	7.532	57	1.695	P	0.031	P	0.220
8	15.231	58	5.652	L	0.096	L	0.371
9	16.213	62	5.686	I	0.094	I	0.351
10	14.802	68	4.941	C	0.082	C	0.334
11	14.657	73	5.052	A	0.082	A	0.345
12	14.450	78	3.040	B	0.067	B	0.210
13	14.711	81	0.518	L	0.020	L	0.035
14	14.464	83	5.517	E	0.090	E	0.381
15	14.230	79	5.142		0.086		0.361
16	13.913	72	4.602		0.080		0.331
17	14.029	78	5.078		0.084		0.362
18	13.794	83	4.929		0.081		0.357
19	13.785	81	2.592		0.065		0.188
20	13.939	77	1.085		0.037		0.078
21	13.808	72	4.574		0.081		0.331
22	13.125	72	3.931		0.081		0.299
23	13.167	77	4.632		0.079		0.352
24	14.293	77	4.843		0.079		0.339
25	13.987	82	5.026		0.084		0.359
26	14.117	85	3.263		0.072		0.231
27	13.800	76	1.583		0.046		0.115
28	14.254	71	1.730		0.047		0.121
29	14.766	71	4.797		0.079		0.325
30	14.408	76	5.253		0.087		0.365
31	14.103	81	5.517		0.091		0.391
SUM	430.279	-	119.503	N.A.	2.188	N.A.	-
AVG	13.880	73	3.855	N.A.	0.071	N.A.	0.278
NBS ID	C001	N113			C102		N111

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
COLLECTOR ARRAY PERFORMANCE

SITE: ARATEX SERVICES, INC. SCLAR/2008-79/05
REPORT PERIOD: MAY,1979

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	DAYTIME AMBIENT TEMP DEG F	COLLECTOR ARRAY EFFICIENCY
1	13.623	10.275	3.590	71	0.264
2	10.811	7.722	2.951	73	0.273
3	13.977	11.938	4.917	82	0.352
4	13.383	11.104	4.241	81	0.317
5	13.808	8.696	2.286	76	0.166
6	15.072	5.108	0.877	69	0.058
7	7.533	4.277	1.655	62	0.220
8	15.231	13.179	5.652	63	0.371
9	16.213	14.039	5.686	72	0.351
10	14.802	12.495	4.941	79	0.334
11	14.657	12.405	5.052	86	0.345
12	14.450	10.615	3.040	92	0.210
13	14.711	3.187	0.518	94	0.035
14	14.494	12.931	5.517	97	0.381
15	14.230	12.406	5.142	91	0.361
16	13.913	11.602	4.602	82	0.331
17	14.029	12.124	5.078	91	0.362
18	13.794	11.660	4.929	97	0.357
19	13.785	9.503	2.592	91	0.188
20	13.939	5.851	1.085	88	0.078
21	13.808	11.527	4.574	81	0.331
22	13.125	10.685	3.931	80	0.299
23	13.167	11.159	4.632	87	0.352
24	14.293	11.799	4.843	87	0.339
25	13.987	11.997	5.026	92	0.359
26	14.117	10.805	3.263	98	0.231
27	13.800	7.365	1.583	89	0.115
28	14.254	7.988	1.730	81	0.121
29	14.766	12.234	4.797	81	0.325
30	14.408	12.559	5.253	86	0.365
31	14.103	12.599	5.517	91	0.391
SUM	430.279	321.835	119.503	-	-
AVG	13.880	10.382	3.855	84	0.278
NBSID	G001		G100		N100

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
STORAGE PERFORMANCE

SITE: ARATEX SERVICES, INC. SOLAR/2008-79/05
REPORT PERIOD: MAY, 1979

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	CHANGE IN STORED ENERGY MILLION BTU	STORAGE AVERAGE TEMP DEG F	STORAGE EFFICIENCY
1	3.990	3.990	-0.424	126	0.882
2	2.951	2.951	0.019	123	1.007
3	4.917	4.917	0.004	126	1.001
4	4.241	4.241	0.767	129	1.181
5	2.286	2.286	2.649	150	2.159
6	0.877	0.877	1.040	169	2.186
7	1.659	1.659	-6.051	128	-2.648
8	5.652	5.652	-1.180	99	0.791
9	5.686	5.686	3.439	109	1.605
10	4.941	4.941	0.530	127	1.107
11	5.052	5.052	0.573	131	1.113
12	3.040	3.040	3.511	158	2.155
13	0.518	0.518	0.412	179	1.796
14	5.517	5.517	-4.164	146	0.245
15	5.142	5.142	0.122	132	1.024
16	4.602	4.602	-0.800	129	0.826
17	5.078	5.078	0.241	128	1.048
18	4.929	4.929	0.228	132	1.046
19	2.592	2.592	2.791	158	2.077
20	1.085	1.085	2.152	180	2.984
21	4.574	4.574	-5.279	139	-0.154
22	3.931	3.931	-0.401	125	0.898
23	4.632	4.632	0.758	127	1.164
24	4.843	4.843	0.292	132	1.060
25	5.026	5.026	0.263	134	1.052
26	3.263	3.263	-1.155	155	0.646
27	1.583	1.583	-0.055	167	0.965
28	1.730	1.730	0.185	168	1.107
29	4.797	4.797	-0.123	138	0.974
30	5.253	5.253	-0.390	125	0.926
31	5.517	5.517	0.268	126	1.049
SUM	119.503	119.503	0.223	-	-
AVG	3.855	3.855	0.007	139	1.002
NBS ID	Q200	Q201	Q202		N108

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
HOT WATER SUBSYSTEM

SITE: ARATEX SERVICES, INC.
REPORT PERIOD: MAY,1979

SOLAR/2008-79/05

DAY OF MON.	HOT WATER LOAD MILLION BTU	SOLAR FR.OF LOAD PER CENT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	SUP. WAT. TEMP DEG F	HOT WAT. TEMP DEG F	HOT WATER USED GAL
1	18.005	20	3.590	0.536	14.415	N	24.072	N	5.984	105	170	33464
2	24.795	12	2.951	0.583	21.844	C	36.480	C	4.919	112	173	46725
3	22.038	22	4.917	0.571	17.121	T	28.592	T	8.195	113	173	42595
4	19.553	22	4.241	0.542	15.311		25.569		7.069	108	177	35988
5	2.286	100	2.286	0.069	0.000	A	0.000	A	3.810	104	180	0
6	0.877	100	0.877	0.002	0.000	P	0.000	P	1.461	104	180	0
7	24.433	7	1.659	0.602	22.774	P	38.033	P	2.764	102	179	38805
8	36.375	16	5.652	0.565	30.724	L	51.308	L	9.420	82	173	46530
9	28.963	20	5.686	0.619	23.278	I	38.874	I	9.476	95	172	46826
10	23.560	21	4.941	0.584	18.619	C	31.094	C	8.235	111	173	45742
11	18.381	27	5.052	0.642	13.329	A	22.259	A	8.420	110	172	33543
12	3.040	100	3.040	0.041	0.000	B	0.000	B	5.066	109	169	0
13	0.518	100	0.518	0.002	0.000	L	0.000	L	0.863	109	169	0
14	23.110	24	5.517	0.571	17.593	E	29.380	E	9.195	108	175	41131
15	22.404	23	5.142	0.570	17.262		28.828		8.571	111	175	43350
16	17.861	26	4.602	0.587	13.258		22.142		7.670	110	176	32918
17	20.349	25	5.078	0.597	15.271		25.503		8.463	106	176	38345
18	19.372	25	4.929	0.601	14.443		24.119		8.215	107	174	36753
19	2.592	100	2.592	0.019	0.000		0.000		4.320	108	172	0
20	1.085	100	1.085	0.003	0.000		0.000		1.808	108	172	0
21	22.787	20	4.574	0.575	18.213		30.415		7.624	106	175	36740
22	16.889	23	3.931	0.575	12.959		21.641		6.551	109	173	31161
23	18.983	24	4.632	0.599	14.351		23.966		7.720	111	177	35723
24	17.395	28	4.843	0.539	12.553		20.963		8.071	112	176	31767
25	15.947	32	5.026	0.541	10.921		18.238		8.376	112	176	29131
26	3.263	100	3.263	0.017	0.000		0.000		5.438	113	178	0
27	1.583	100	1.583	0.021	0.000		0.000		2.639	113	178	0
28	1.730	100	1.730	0.023	0.000		0.000		2.883	113	178	0
29	21.721	22	4.797	0.613	16.924		28.264		7.995	116	175	40236
30	23.086	23	5.253	0.645	17.833		29.781		8.755	117	172	44456
31	19.398	28	5.517	0.652	13.881		23.181		9.195	114	172	37538
SUM	492.377	-	119.503	13.008	372.874	N.A.	622.699	N.A.	199.173	-	-	849468
AVG	15.883	24	3.855	0.420	12.028	N.A.	20.087	N.A.	6.425	108	174	27402
NBS	Q302	*300	Q300	Q303	Q301	Q305	Q306	Q311	Q313	N305	N307	N308

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENVIRONMENTAL SUMMARY

SITE: ARATEX SERVICES, INC.
REPORT PERIOD: MAY,1979

SOLAR/2008-79/05

DAY OF MONTH	TOTAL INSOLATION BTU/SQ.FT	DIFFUSE INSOLATION BTU/SQ.FT	AMBIENT TEMPERATURE DEG F	DAYTIME AMBIENT TEMP DEG F	RELATIVE HUMIDITY PERCENT	WIND DIRECTION DEGREES	WIND SPEED M.P.H.
1	2087	N	61	71	N	107	8
2	1656	O	65	73	O	0	1
3	2141	T	72	82	T	114	3
4	2050		70	81		114	4
5	2115	A	66	76	A	108	7
6	2309	P	61	69	P	108	9
7	1154	P	57	62	P	121	4
8	2333	L	58	63	L	107	10
9	2484	I	62	72	I	118	4
10	2267	C	68	79	C	*	2
11	2245	A	73	86	A	0	2
12	2213	E	78	92	B	0	2
13	2254	L	81	94	L	*	2
14	2220	E	83	97	E	0	2
15	2180		79	91		82	3
16	2131		72	82		104	4
17	2149		78	91		99	3
18	2113		83	97		103	3
19	2112		81	91		95	4
20	2135		77	88		102	4
21	2115		72	81		103	6
22	2011		72	80		101	5
23	2017		77	87		105	5
24	2189		77	87		101	5
25	2143		82	92		79	2
26	2163		85	98		96	4
27	2114		76	89		100	5
28	2184		71	81		103	5
29	2262		71	81		97	4
30	2207		76	86		90	2
31	2160		81	91		0	2
SUM	65913	N.A.	-	-	-	-	-
AVG	2126	N.A.	73	84	N.A.	100	4
NBS ID	G001		N113			N115	N114

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
HEAT RECOVERY SYSTEM

SITE: ARATEX SERVICES, INC. SOLAR/2008-79/05
REPORT PERIOD: MAY,1979

DAY OF MONTH	HEAT RECOVERY ENERGY(HR) MILLION BTU	SOLAR FRACTION OF HRS ENERGY MILLION BTU	AUXILIARY FRACTION HRS ENERGY MILLION BTU	SUPPLY WATER TEMP DEG F	SOLAR FRACTION OF LOAD PERCENT	HEAT REC SYS OPER ENERGY MILLION BTU
1	9.375	2.070	7.305	75	19.940	0.048
2	13.525	1.746	11.779	74	11.902	0.065
3	12.652	2.908	9.743	74	22.312	0.061
4	10.223	2.493	7.730	75	21.693	0.065
5	0.000	0.000	0.000	75	100.000	0.007
6	0.000	0.000	0.000	75	100.000	0.000
7	7.872	0.659	7.213	76	6.788	0.048
8	1.351	0.029	1.322	75	15.538	0.006
9	8.606	2.685	5.921	74	19.630	0.044
10	13.466	3.101	10.366	75	20.972	0.062
11	9.275	2.406	6.869	75	27.486	0.063
12	0.000	0.000	0.000	74	100.000	0.004
13	0.000	0.000	0.000	74	100.000	0.000
14	10.905	3.001	7.904	76	23.873	0.058
15	12.840	2.924	9.916	75	22.953	0.065
16	9.028	2.333	6.695	75	25.767	0.052
17	10.848	2.755	8.093	76	24.954	0.060
18	10.668	2.829	7.839	77	25.445	0.055
19	0.000	0.000	0.000	78	100.000	0.011
20	0.000	0.000	0.000	78	100.000	0.000
21	7.728	2.021	5.707	76	20.074	0.044
22	8.450	2.092	6.358	76	23.273	0.050
23	9.865	2.563	7.302	76	24.402	0.049
24	8.480	2.651	5.829	76	27.839	0.044
25	8.288	2.820	5.468	76	31.516	0.044
26	0.000	0.000	0.000	75	100.000	0.017
27	0.000	0.000	0.000	75	100.000	0.023
28	0.000	0.000	0.000	75	100.000	0.026
29	11.573	2.770	8.803	75	22.085	0.057
30	13.036	2.951	10.085	74	22.755	0.063
31	11.039	3.123	7.916	75	28.441	0.060
SUM	219.094	52.930	166.164	-	-	1.253
AVG	7.068	1.707	5.360	75	24.271	0.040

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

UNIVERSITY OF FLORIDA
3 1262 09052 6749